

1 Claims

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3 1. Apparatus for controlling the flow of fluid
4 into a borehole through a conduit, the apparatus
5 comprising a decelerating means adapted to be
6 positioned within the conduit for slowing down the
7 flow of fluid through the conduit.

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9 2. Apparatus as claimed in claim 1, wherein the
10 decelerating means comprises a passage in the
11 apparatus.

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13 3. Apparatus as claimed in claim 2, wherein the
14 passage is defined by at least one body member
15 having formations thereon.

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17 4. Apparatus as claimed in claim 3, including a
18 shoe adapted for engagement with the at least one
19 body member.

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21 5. Apparatus as claimed in claim 4, including an
22 anti-rotation means to prevent relative rotation of
23 the at least one body member and the shoe.

24

25 6. Apparatus as claimed in claim 5, wherein the
26 anti-rotation means includes a device shaped to
27 engage a bore provided in the shoe.

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29 7. Apparatus as claimed in claim 5 or claim 6,
30 wherein the anti-rotation means comprises a tapered
31 edge provided on one of the device and the shoe and

1 a correspondingly shaped groove provided on the
2 other of the device and the shoe.

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4 8. Apparatus as claimed in claim 6 or claim 7 when
5 dependent on claim 6, including an axial locking
6 means to prevent axial separation of the device and
7 the shoe.

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9 9. Apparatus as claimed in claim 8, wherein the
10 axial locking means comprises a latch provided on
11 one of the device and the shoe, and a groove
12 provided on the other of the device and the shoe.

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14 10. Apparatus as claimed in claim 8 or claim 9 when
15 dependent on claim 5, wherein the anti-rotation
16 means prevents relative rotation of the at least one
17 body member and the shoe once the axial locking
18 means has engaged.

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20 11. Apparatus as claimed in any of claims 3 to 10,
21 wherein the apparatus includes a shroud which is
22 disposed around the at least one body member.

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24 12. Apparatus as claimed in claim 11, wherein the
25 shroud is provided with apertures in the side wall
26 thereof.

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28 13. Apparatus as claimed in any of claims 2 to 12,
29 used in conjunction with equipment having at least
30 one valve, wherein the cross-sectional area of the
31 passage is greater than the cross-sectional area of
32 the at least one valve.

1 14. Apparatus as claimed in any of claims 2 to 13,
2 wherein the passage has constant dimensions.

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4 15. Apparatus as claimed in any of claims 2 to 14,
5 wherein the boundaries of the passage are smooth and
6 free of obstructions.

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8 16. Apparatus as claimed in any of claims 2 to 15,
9 wherein the passage is inclined relative to the axis
10 of the conduit and wherein deceleration of the fluid
11 is caused by friction between the fluid and the
12 inclined passage.

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14 17. Apparatus as claimed in any of claims 2 to 16,
15 wherein the passage is inclined relative to a plane
16 perpendicular to the axis of the conduit.

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18 18. Apparatus as claimed in claim 16 or claim 17,
19 wherein the inclination of the passage is continual
20 throughout the length of the passage.

21

22 19. Apparatus as claimed in any of claims 2 to 18,
23 wherein the passage is uni-directional in the axial
24 direction.

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26 20. Apparatus as claimed in any of claims 2 to 19,
27 wherein the passage includes at least one spiral
28 portion.

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30 21. Apparatus as claimed in claim 20, wherein the
31 angle of the spiral portion of the passage is more
32 than 60 degrees relative to the axis of the conduit.

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2 22. Apparatus as claimed in claim 20 or claim 21,
3 wherein the angle of the spiral portion of the
4 passage is between 70 degrees and 80 degrees
5 relative to the axis of the conduit.

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7 23. Apparatus as claimed in any of claims 2 to 22,
8 wherein the passage includes at least one portion
9 which spirals in a first spiral direction and at
10 least one further portion which spirals in a second
11 opposite spiral direction.

12

13 24. Apparatus as claimed in claim 23, wherein a
14 cavity is provided between the at least two
15 oppositely directed spiral passage portions,
16 providing a space in which the fluid changes
17 direction between a first spiral direction and a
18 second spiral direction.

19

20 25. Apparatus as claimed in any preceding claim,
21 wherein the decelerating means is adapted to induce
22 turbulence into the fluid.

23

24 26. Apparatus as claimed in claim 25, wherein the
25 turbulence is at least partially induced by a
26 direction altering means which causes a change in
27 the flow direction.

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29 27. Apparatus as claimed in claim 25 or claim 26
30 when dependent on claim 25, wherein the turbulence
31 is induced in the cavity between the at least two
32 oppositely-directed spiral passage portions.

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2 28. Apparatus as claimed in any preceding claim,
3 wherein the conduit comprises drillpipe, tubing,
4 coiled tubing, filtration screen, casing or liner
5 string.

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7 29. A control assembly, including:

8 control apparatus for controlling the flow of
9 fluid into a borehole through a conduit, the
10 apparatus comprising a decelerating means adapted to
11 be positioned within the conduit for slowing down
12 the flow of fluid through the conduit, the
13 decelerating means comprising a passage in the
14 apparatus;

15 a conduit in which the control apparatus is
16 located; and

17 a valve located in the conduit above the
18 apparatus;

19 wherein the cross-sectional area of the passage
20 in the apparatus is greater than the cross-sectional
21 area of the valve.

22

23 30. An assembly as claimed in claim 29, wherein the
24 valve is located in a float collar.

25

26 31. A method of controlling the passage of fluid
27 through a conduit located in a borehole, including
28 the step of decelerating the fluid.

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30 32. A method as claimed in claim 31, including the
31 step of causing the fluid to deviate from the

1 conduit into a passage which is inclined relative to
2 the conduit axis.

3

4 33. A method as claimed in claim 32, wherein the
5 fluid is decelerated by friction between the fluid
6 and the boundaries of the inclined passage.

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8 34. A method as claimed in claim 32 or 33, wherein
9 the inclined passage has constant dimensions and the
10 boundaries of the passage are free of obstructions
11 so that the fluid moves along the passage without
12 hindrance.

13

14 35. A method as claimed in any of claims 31 to 34,
15 including the step of causing the fluid to travel in
16 a spiral direction.

17

18 36. A method as claimed in claim 35, wherein the
19 fluid is caused to travel in a tight spiral so that
20 it travels through a large distance in a small axial
21 space.

22

23 37. A method as claimed in claim 35 or claim 36,
24 wherein the fluid is caused to travel in a first
25 spiral direction and subsequently in a second
26 opposite spiral direction.

27

28 38. A method as claimed in any of claims 32 to 37
29 when dependent on claim 32, wherein a float collar
30 having a valve is provided in the conduit above the
31 inclined passage, and wherein the passage has a
32 greater cross-sectional area than the cross-

1 sectional area of the valve so that the fluid flows
2 without restriction into the passage.

3

4 39. A method as claimed in any of claims 31 to 38,
5 including the step of inducing turbulence into the
6 fluid.

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8 40. A method as claimed in claim 39 when dependent
9 on claim 38, wherein the turbulence is induced by
10 causing the fluid to change direction from the first
11 spiral direction to the second spiral direction.

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13 41. A method as claimed in any of claims 32 to 40,
14 wherein the inclined passage is defined by at least
15 one body member having formations thereon and
16 wherein a shroud having apertures in its surface is
17 provided around the body member, the method
18 including the step of passing cement through the
19 passage, some of which exits the passage via the
20 apertures to cement the body member to the conduit.